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LIGHTING CONTROL

(57) According to an example embodiment, a method (200) for lighting control is provided, the method (200) comprising: receiving (206), over one or more wireless communication channels at a lighting control apparatus (140), respective one or more lighting control messages from one or more user apparatuses (150), wherein the one or more lighting control messages received from a respective one of the one or more user apparatuses (150) include respective lighting control information at one of two or more predefined priority levels; determining (208), by the lighting control apparatus (140), one or more lighting control actions for controlling respective light outputs of one or more luminaires (120) based on the respective lighting control information received from said one or more user apparatuses (150) in accordance with the respective priority levels; and controlling (210), by the lighting control apparatus (140), the respective light outputs of one or more luminaires (120) in accordance with the determined one or more lighting control actions.

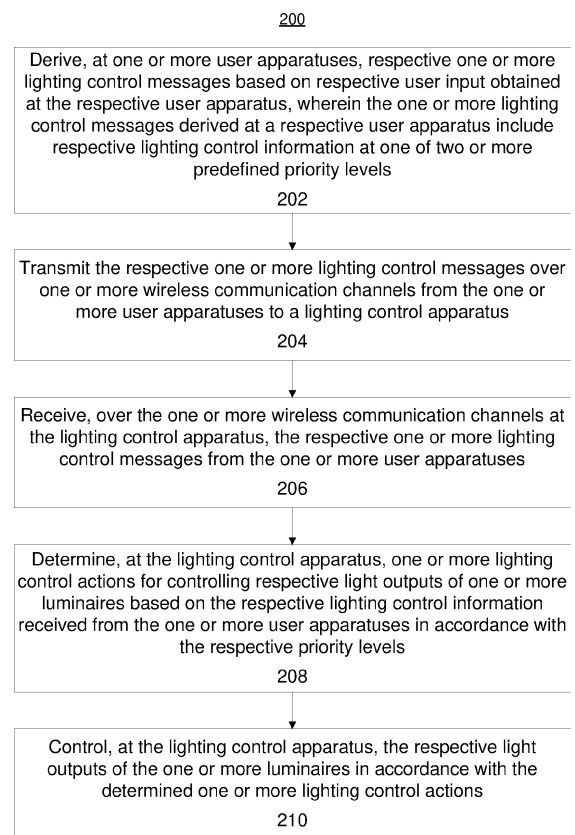


Figure 4

Description

TECHNICAL FIELD

[0001] The present invention relates to sharing of environmental data captured by one or more sensors that are coupled to a lighting control network.

BACKGROUND

[0002] Various aspects of light output provided by luminaires of a lighting system are nowadays automatically or semi-automatically controlled e.g. based on sensor data captured in the illuminated space, to provide illumination that guarantees illumination levels considered suitable for the illuminated space by a lighting designer. In this regard, the suitable illumination levels may be based on, for example, relevant standards or norms that define requirements and/or recommendations for illumination levels in spaces intended for specific purposes.

[0003] While the automated or semi-automated lighting control may be applied for providing suitable trade-off between ensuring sufficient illumination level when the space under consideration is occupied and providing energy savings via keeping the lights at a lower level or completely off when the space under consideration is unoccupied, in many scenarios there is a need - and sometimes even a requirement - to also enable manual lighting control to account for specific needs and/or preferences of one or more occupants of the space under consideration. In this regard, the manual control may be enabled e.g. via control panels arranged in the illuminated space or in its proximity or via a digital interface that may be accessed by user device which may be designed for this specific purpose (such as a remote control unit) or provided via operation of a general purpose user device (such as a mobile phone, a tablet computer, a laptop computer, etc.).

[0004] Specific needs for a higher-than-usual illumination may arise in illumination of an area intended for working e.g. in scenarios where uncompromised visibility is critical, errors made in the course of the work are impossible or costly to rectify, the work requires exceptional accuracy and/or concentration, etc. In contrast, a preference towards higher-than-usual or lower-than-usual illumination may arise in various situation in illumination of an area intended for working or leisure activities. Quite apparently, in illuminated spaces that are occupied by a number of persons, such as open office spaces, the specific requirements or preferences by occupants of the space may be contradicting each other, which calls for solutions for managing respective lighting-related requirements and preferences indicated by the occupants of the same space.

SUMMARY

[0005] It is an object of the present invention to provide

an approach that allows for increased flexibility in managing lighting control requests received from occupants of an illuminated space.

[0006] According to an example embodiment, a method for lighting control is provided, the method comprising: receiving, over one or more wireless communication channels at a lighting control apparatus, respective one or more lighting control messages from one or more user apparatuses, wherein the one or more lighting control messages received from a respective one of the one or more user apparatuses include respective lighting control information at one of two or more predefined priority levels; determining, by the lighting control apparatus, one or more lighting control actions for controlling respective light outputs of one or more luminaires based on the respective lighting control information received from said one or more user apparatuses in accordance with the respective priority levels; and controlling, by the lighting control apparatus, the respective light outputs of one or more luminaires in accordance with the determined one or more lighting control actions.

[0007] According to another example embodiment, a lighting control apparatus is provided, the apparatus arranged to: receive, over one or more wireless communication channels, respective one or more lighting control messages from one or more user apparatuses, wherein the one or more lighting control messages received from a respective one of the one or more user apparatuses include respective lighting control information at one of two or more predefined priority levels; determine one or more lighting control actions for controlling respective light outputs of one or more luminaires (120) based on the respective lighting control information received from said one or more user apparatuses (150) in accordance with the respective priority levels; and control respective light outputs of one or more luminaires (120) in accordance with the determined one or more lighting control actions.

[0008] According to another example embodiment, a user apparatus is provided, the apparatus arranged to: derive, based on user input obtained at the user apparatus, one or more lighting control messages for transmission to a lighting control apparatus, wherein the one or more lighting control messages include respective lighting control information at one of two or more predefined priority levels; and transmit said one or more lighting control messages over said wireless channel for reception at the lighting control apparatus.

[0009] According to another example embodiment, a system is provided, the system comprising: a lighting control apparatus according to the example embodiment described in the foregoing and one or more user apparatuses according to the example embodiment described in the foregoing,

[0010] The exemplifying embodiments of the invention presented in this patent application are not to be interpreted to pose limitations to the applicability of the appended claims. The verb "to comprise" and its derivatives

are used in this patent application as an open limitation that does not exclude the existence of also unrecited features. The features described in the following examples may be used in combinations other than those explicitly described without departing from the scope of the present disclosure, unless explicitly stated otherwise.

[0011] Some features of the invention are set forth in the appended claims. Aspects of the invention, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of some example embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF FIGURES

[0012] The embodiments of the invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings, where

Figure 1 illustrates a block diagram of some logical elements of a lighting system according to an example;

Figure 2A illustrates a block diagram of some components of a luminaire according to an example;

Figure 2B illustrates a block diagram of some components of a sensor unit according to an example;

Figure 2C illustrates a block diagram of some components of a lighting control apparatus according to an example;

Figure 3 illustrates a block diagram of some logical elements of a lighting system according to an example;

Figure 4 illustrates a method according to an example; and

Figure 5 illustrates a block diagram of some components of an apparatus according to an example.

DESCRIPTION OF SOME EMBODIMENTS

[0013] Figure 1 illustrates a block diagram of some logical elements of a lighting system 100 according to an example. In the example of Figure 1 the lighting system 100 is shown with luminaires 120-1, 120-2, 120-3 and 120-4 for illuminating a space or area and a lighting control apparatus 140 for controlling one or more aspects of respective light outputs of the luminaires 120-1, 120-2, 120-3 and 120-4. The luminaires 120-1 to 120-4 represent one or more luminaires 120, whereas any individual luminaire may be referred to via a reference number 120-k. The lighting control apparatus 140 may be also referred to as a lighting control entity and in various examples the

lighting control apparatus 140 may be embodied as an entity integrated to one of the one or more luminaires 120 or it may be embodied as an entity that is separate from the one or more luminaires 120 as described in further detail in the non-limiting examples provided in the following. The lighting system 100 may be arranged for illuminating a space or area, which may comprise e.g. one or more indoor spaces or areas and/or one or more outdoor areas.

[0014] If implemented as an entity separate from the one or more luminaires 120, the lighting control apparatus 140 may be communicatively coupled to the one or more luminaires 120. While the conceptual illustration of Figure 1 suggests wireless communication between the lighting control apparatus and the one or more luminaires 120, in general the communicative coupling may be provided, for example, via a wireless and/or wired communication network, via a wireless and/or wired communication bus, and/or via wireless and/or wired communication links. In this regard, without losing generality, the communicatively coupling(s) between the one or more luminaires 120 and the lighting control apparatus 140 may be referred to as a lighting control network. Moreover, even if integrated to one of the one or more luminaires 120, the lighting control entity 140 may be communicatively coupled to other elements of the lighting system 100 via the lighting control network.

[0015] Regardless of the manner of embodying the lighting control apparatus 140, the lighting control may be implemented via lighting control commands issued by the lighting control apparatus 140. The lighting control commands may comprise, for example, respective instructions for changing the operational status and/or for adjusting the light intensity of the respective light outputs of the one or more luminaires 120. Non-limiting examples in this regard include the following:

- switching on the respective light outputs of the one or more luminaires 120,
- switching off the respective light outputs of the one or more luminaires 120,
- increasing the light intensity of the respective light outputs of the one or more luminaires 120 by a specified or by a predefined amount,
- decreasing the light intensity of the respective light outputs of the one or more luminaires 120 by a specified or by a predefined amount,
- setting the light intensity of the respective light outputs of the one or more luminaires 120 to a specified or to a predefined light intensity level.

[0016] The lighting control commands may be received at the lighting control apparatus 140 over the lighting control network from another entity and/or the lighting control commands may be derived at the lighting control apparatus 140 on basis of lighting control information received over the lighting control network from another entity or acquired locally at the lighting control apparatus 140. Ac-

cording to an example, the lighting control information may comprise sensor data that is descriptive of environmental conditions in location(s) of the space that are illuminated by the one or more luminaires 120, where the sensor data may be received over the lighting control network from another entity or acquired from one or more sensors provided at the lighting control apparatus 140.

[0017] Figures 2A, 2B and 2C illustrate respective non-limiting examples of different ways of embodying the lighting control apparatus in context of the present disclosure, where the lighting control commands are derived based on the sensor data. In this regard, Figure 2A illustrates a block diagram of some elements of a luminaire 120-k according to an example, where the luminaire 120-k comprises at least one light source 121-k for providing light output of the luminaire 120-k and a lighting control apparatus 140-k for controlling the light output of the luminaire 120-k. The lighting control apparatus 140-k may comprise a communication portion 123-k for wireless and/or wired communication with other entities and a luminaire control portion 124-k for controlling the light output of the luminaire 120-k. The luminaire control apparatus 140-k may serve as the lighting control apparatus 140.

[0018] According to an example, the at least one light source 121-k may comprise one or more light emitting diodes (LEDs) and the luminaire control portion 124-k may comprise or it may be provided as a LED driver device, whereas in another non-limiting example the at least one light source 121-k may comprise one or more fluorescent lamps and the luminaire control portion 124-k may comprise or it may be provided as an electronic ballast. According to an example, the lighting control apparatus 140-k may comprise a processor and a memory, where the memory is arranged to store computer program code that, when executed by the processor, implements operation of the luminaire control portion 124-k according to the present disclosure. More detailed examples in this regard are described later in this text with references to Figure 5.

[0019] According to an example, the luminaire control portion 124-k may control one or more aspects of light output provided from the at least one light source 121-k based on sensor data received over the lighting control network. In particular, the luminaire 120-k may receive sensor data that is descriptive of one or more environmental characteristics at the location of the space or area illuminated by the luminaire 120-k, whereas the luminaire control portion 124-k may derive lighting control commands based on the received sensor data and control the light output of the luminaire 120-k accordingly. Hence, luminaire control portion 124-k at the luminaire 120-k according to the example of Figure 2A may serve to provide local lighting control based on the sensor data captured at one or more sensors provided in one or more sensor units that are coupled to the luminaire 120-k via the lighting control network.

[0020] In terms of wireless communication, the com-

munication portion 123-k may comprise a wireless communication apparatus, e.g. a wireless transceiver, that is capable of communicating with respective communication apparatuses provided in other apparatuses via use of one or more predefined wireless communication techniques or protocols. As an example in this regard, the wireless communication may be carried out via using a suitable short-range wireless communication technique known in the art that enables communication over ranges from a few meters up to a few hundred meters. Examples of suitable short-range wireless communication techniques include Bluetooth, Bluetooth Low-Energy (BLE), ZigBee, WLAN/Wi-Fi according to an IEEE 802.11 family of standards, etc. The choice of the wireless communication technique and network topology applied for a specific implementation of the lighting control network may depend e.g. on the required communication range and/or requirements with respect to energy-efficiency of the communication apparatuses. In terms of wired communication, the communication portion 123-k may comprise a wired transceiver or a communication interface for communication over a wired network or a wired bus according to a predefined lighting control protocol, such as the Digital Addressable Lighting Interface (DALI) specified in a series of technical standards IEC 62386.

[0021] Figure 2B illustrates a block diagram of some elements of a sensor unit 130 according to an example, where the sensor unit 130 comprises a sensor portion 132 and a lighting control apparatus 140b. The sensor portion 132 may comprise one or more sensors for observing one or more environmental characteristics at the location of the space or area illuminated by the one or more luminaires 120, whereas the lighting control apparatus 140b may comprise a communication portion 133 for wireless and/or wired communication with other entities and a sensor control portion 134 for controlling at least one aspect of operation of the sensor unit 130, for processing sensor data captured at the sensor portion 132 and/or for controlling the respective light outputs of the one or more luminaires 120. The luminaire control apparatus 140b may serve as the lighting control apparatus 140. According to an example, the lighting control apparatus 140b may comprise a processor and a memory, where the memory is arranged to store computer program code that, when executed by the processor, implements operation of the sensor control portion 134 according to the present disclosure. More detailed examples in this regard are described later in this text with references to Figure 5. The communication portion 133 may be similar to the communication portion 123-k described in the foregoing.

[0022] According to an example, the sensor control portion 134 may control one or more aspects of light output provided from the one or more luminaires 120 based on the sensor data acquired from the one or more sensors of the sensor portion 132. As an example in this regard, the sensor control portion 134 may derive the lighting control commands based on the sensor data captured

at the sensor unit 130 and transmit the derived lighting control commands over the lighting control network to the one or more luminaires 120 for controlling their respective light outputs accordingly. Hence, the sensor unit 130 according to the example of Figure 2B may serve to provide remote and/or centralized lighting control for the one or more luminaires 120 based on the sensor data captured at the sensor unit 130.

[0023] Figure 2C illustrates a block diagram of some elements of a lighting control apparatus 110 according to an example, where the lighting control apparatus 110 may comprise a communication portion 113 for wireless and/or wired communication with other entities and a lighting control portion 114 for controlling the respective light outputs of the one or more luminaires 120. The lighting control apparatus 110 may serve as the lighting control apparatus 140. According to an example, the lighting control apparatus 110 may comprise a processor and a memory, where the memory is arranged to store computer program code that, when executed by the processor, implements operation of the lighting control portion 114 according to the present disclosure. More detailed examples in this regard are described later in this text with references to Figure 5. The communication portion 113 may be similar to the communication portion 123-k described in the foregoing.

[0024] According to various examples, the lighting control provided via operation of the lighting control portion 114 may rely on sensor data received over the lighting control network from one or more other entities of the lighting system 100. As an example in this regard, the lighting control portion 114 may derive the lighting control commands based on the sensor data received at the lighting control apparatus 110 and transmit the derived lighting control commands over the lighting control network to the one or more luminaires 120 for controlling their respective light outputs accordingly. Hence, the lighting control apparatus 110 according to the example of Figure 2C may serve to provide remote and/or centralized lighting control for the one or more luminaires 120 based on the sensor data captured at one or more sensors provided in one or more sensor units that are coupled to the lighting control apparatus 110 via the lighting control network.

[0025] In a further example not illustrated in Figures 2A to 2C, the sensor portion 132 may be implemented in or integrated to the luminaire 120-k and, consequently, derivation of the lighting control commands at the luminaire control portion 124-k may rely on sensor data captured locally at the luminaire 120-k instead of the sensor data received over the lighting control network from another entity. Such an approach enables substantially autonomous operation of the luminaire 120-k.

[0026] While the non-limiting examples described in the foregoing rely on lighting control that is based on lighting control commands received at the lighting control apparatus 140 based on sensor data that represents one or more environmental characteristics in the space or

area illuminated by the one or more luminaires 120, in other examples the lighting control via operation of the lighting control apparatus 140 may, additionally or alternatively, rely on lighting control commands or lighting control signals received at the lighting control apparatus 140 from external sources. An example in this regard involves lighting control commands or lighting control signals received from a control panel arranged in the space or area illuminated by the one or more luminaires 120 or in its proximity, where the control panel may enable occupants of the space or area to directly control at least some aspects of the light output of the one or more luminaires 120, e.g. via switching the lights on or off and/or via adjusting the light intensity of the light output of the one or more luminaires 120.

[0027] Figure 3 illustrates a block diagram of some elements of the lighting system 100, further provided with a digital interface for adjusting the light output of the one or more luminaires 120 via operation of a user apparatus 150. According to an example, the user apparatus 150 may comprise a processor and a memory, where the memory is arranged to store computer program code that, when executed by the processor, implements operation of the user apparatus 150 according to the present disclosure. More detailed examples in this regard are described later in this text with references to Figure 5. Moreover, the user apparatus may comprise a communication portion that is capable of wireless communication with the lighting control apparatus 140. The user apparatus 150 may comprise, for example, a user device such as a mobile phone (e.g. a smartphone), a smartwatch, a tablet computer, a laptop computer, a desktop computer, etc.

[0028] The user apparatus 150 may execute a lighting control application that enables controlling at least some aspects of the respective light outputs of the one or more luminaires 120 based on user input received via a user interface (UI) of the user apparatus 150 and/or pre-stored in a memory at the user apparatus 150. In particular, the lighting control application executing in the user apparatus 150 may derive the one or more lighting control messages based on the user input and transmit the one or more lighting control messages from the user apparatus 150 to the lighting control apparatus 140, where the one or more lighting control messages include lighting control information for determining and applying respective lighting control actions and/or lighting control commands at the lighting control apparatus 140. The lighting control messages originating from the user apparatus 150 may enable personalized lighting control at and/or close to the current location of the user apparatus 150 that accounts for specific characteristic of activities carried out in the illuminated space or area and/or for personal characteristics or preferences of a certain user.

[0029] In this regard, the one or more lighting control messages sent from the user apparatus 150 to the lighting control apparatus 140 may be conveyed via a one or more wireless communication channels between these

two entities. These one or more wireless communication channels may be provided over a wireless communication link or a wireless communication network that enables connecting the user apparatus 150 to the lighting control apparatus 140. According to an example, the one or more wireless communication channels applied for transferring the one or more lighting control messages may be separate from the lighting control network connecting the entities of the lightings system 100, whereas according to another example the one or more wireless communication channels may be provided via the lighting control network.

[0030] While the illustration of Figure 3 shows only a single user apparatus 150, in various scenarios there may be one or more user apparatuses 150 transmitting respective one or more lighting control messages that convey respective lighting control information over the one or more wireless communication channels to the lighting control apparatus 140. According to an example, the one or more wireless communication channels may be shared by the one or more use apparatuses 150 in communication with the control apparatus 140, in another example at least one (but not necessarily all) of the one or more wireless communication channels may be shared by the one or more use apparatuses 150 in communication with the control apparatus 140, whereas in a further example each user apparatus 150 may apply respective one or more wireless communication channels in communicating with the control apparatus 140.

[0031] In a scenario where the lighting control apparatus 140 receives respective one or more lighting control messages from a plurality of user apparatuses 150, the lighting control apparatus 140 may need to process respective lighting control information received from the one or more user apparatuses 150, determine the resulting lighting control actions or lighting control commands in accordance with one or more predefined tie-breaking rules, and control the respective light outputs of the one or more luminaires 120 accordingly. The procedure that involves the one or more user apparatuses 150 deriving the respective one or more lighting control messages and transmitting these messages to the lighting control apparatus 140 and the lighting control apparatus 140 receiving and applying the respective lighting control information received in the respective lighting control messages originating from the one or more user apparatuses 150 may be described in form of a method. As an example in this regard, Figure 4 illustrates a method 200 for lighting control in the framework of the lighting system 100, where the method 200 may comprise e.g. the following steps:

- derive, at the one or more user apparatuses 150, the respective one or more lighting control messages based on respective user input obtained at the respective user apparatus 150, wherein the one or more lighting control messages derived at a respective user apparatus 150 include respective lighting control information at one of two or more predefined

priority levels (block 202);

- transmit the respective one or more lighting control messages over the one or more wireless communication channels from the one or more user apparatuses 150 to the lighting control apparatus 140 (block 204),
- receive, over the one or more wireless communication channels at the lighting control apparatus 140, the respective one or more lighting control messages from the one or more user apparatuses 150 (block 206);
- determine, at the lighting control apparatus 140, one or more lighting control actions for controlling the respective light outputs of the one or more luminaires 120 based on the respective lighting control information received from the one or more user apparatuses 150 in accordance with the respective priority levels (block 208); and
- control, at the lighting control apparatus 140, the respective light outputs of the one or more luminaires 120 in accordance with the determined one or more lighting control actions (block 210).

[0032] The respective operations described with references to the method steps represented by blocks 202 to 210 may be varied or complemented in a number of ways, e.g. according to the examples that pertain to operation and/or characteristics of elements of the lighting system 100 and the one or more user apparatuses 150 described in the foregoing and/or in the following. Moreover, the method 200 may be complemented with one or more additional steps, and/or some of the method steps may be omitted without departing from the scope of the lighting control approach according to the method 200. As non-limiting examples of such omitting of method steps, the method 200 may be split into a first portion that involves the respective operations pertaining to blocks 202 and 204 carried out at the one or more user apparatuses 150 and a second portion that involves the respective operations pertaining to blocks 206 to 210 carried out at the lighting control apparatus 140.

[0033] Along the lines described in the foregoing, the one or more lighting control messages transmitted from the user apparatus 150 include lighting control information at one of the two or more predefined priority levels, where the lighting control information is either directly or indirectly descriptive of lighting control actions requested from the user apparatus 150. The predefined priority levels may include a first priority level and a second priority level, where the first priority level is higher than the second priority level. According to an example, the first and second priority levels may be the only available priority levels applied in lighting control approach according to the method 200, whereas according to another example there may be one or more further priority levels. In the latter example, the further priority levels may include one or more priority levels that are higher than the first priority level and/or one or more priority levels that are lower than

the second priority level. Application of the two or more priority levels may be such that any lighting control information assigned a higher priority level takes precedence over any lighting control information assigned a lower priority. Consequently, in consideration of the first and second priority levels described above, any lighting control information assigned the first priority level takes precedence over any lighting control information assigned the second priority level.

[0034] According to an example, the lighting control information assigned the first priority level may comprise a request for increasing the light level in the space or area illuminated by the one or more luminaires 120, whereas the lighting control apparatus 140 may respond reception of such a request by increasing the light intensity applied for the respective light outputs of the one or more luminaires 120 accordingly. As an example in this regard, the lighting control information at the first priority level may include an indication of a request to increase the light level by a predefined amount, whereas the lighting control apparatus 140 may respond to such an indication by controlling the one or more luminaires 120 to implement the requested increase in the light level. Examples in this regard include the following:

- the lighting control information may include an indication of a request to increase the light level by a predefined amount above a predefined reference light level,
- the lighting control information may include an indication of a request to increase the light level by a predefined amount from the current light level.

[0035] In this regard, the lighting control information that requests increasing the light level by the predefined amount above the reference light level may enable requesting a change from light output that provides a nominal light level (defined e.g. in accordance with an applicable norm or standard) to an increased light level.

[0036] As another example of the lighting control information at the first priority level including an indication to increase the light level, the lighting control information may include an indication of a requested amount of increase in the light level, whereas the lighting control apparatus 140 may respond to such an indication by controlling the one or more luminaires 120 to implement the indicated increase in the light level. Examples in this regard include the following:

- the lighting control information may include an indication of a requested amount of increase with respect to a predefined reference light level,
- the lighting control information may include an indication of a requested amount of increase in light level with respect to the current light level.

[0037] According to an example, the lighting control apparatus 140 may allow for adjustment of the light level

by substantially any amount (in view of the maximum light output of the one or more luminaires 120) and in such a scenario the lighting control information may substantially freely specify the requested increase in the light level. According to another example, the lighting control apparatus 140 may allow for adjustment of the light level in steps of predefined size and in such a scenario the lighting control information may specify the amount of increase e.g. via specifying the corresponding number of steps for increasing the light level. In a further example of the lighting control information at the first priority level including an indication to increase the light level, the lighting control information may include respective indications of one or more reason codes for increasing the light level, whereas the resulting increase in the light level may be determined at the lighting control apparatus 140 based on predefined mapping between the reason codes and the corresponding increase in the light level. The one or more reason codes included in the lighting control information may include respective reason codes chosen among a plurality of predefined reason codes, each mapped to a corresponding increase in the light level. In various examples in this regard, the increase in light level may be defined as a respective predefined increase in comparison to the reference light level or the increase in light level may be defined as a respective predefined increase in comparison to the current light level. Herein, applicable reason codes may include, for example, a first reason code that serves to indicate a request for increased light level due to a characteristic of the tasks carried out in the illuminated space or area and/or a second reason code that serves to indicate a request for increased light level due to a characteristic of a user of the user apparatus 150 from which the respective lighting control information is transmitted.

[0038] According to an example, the lighting control information assigned the second priority level may comprise a request to change a characteristic of the respective light outputs of the one or more luminaires 120, whereas the lighting control apparatus 140 may respond reception of such a request by adjusting the respective characteristics of the respective light outputs of the one or more luminaires 120 accordingly. As an example in this regard, the lighting control information at the second priority level may include an indication of a request to adjust one of the following characteristics of the light output, whereas the lighting control apparatus 140 may respond to such an indication by controlling the one or more luminaires 120 to implement respective adjustment in characteristics of their light output. Examples of such adjustable light output characteristics include the following:

- the light level in the space or area illuminated by the one or more luminaires 120,
- a color of the light output of the one or more luminaires 120,
- a color temperature of the light output of the one or more luminaires 120,

- temporal variations applied in the light output of the one or more luminaires 120.

[0039] In an example where the lighting control information at the second priority level includes a request to change the light level, the request may comprise, for example, one of the following: an identification of a requested one of two or more predefined light levels, a direct indication of a requested light level, an indication of a requested change (i.e. increase or decrease) in the light level with respect to the predefined reference light level, an indication of a requested change (i.e. increase or decrease) in the light level with respect to the current light level, where the requested amount of change in the light level may be specified directly (e.g. as an absolute change) or as a number of steps of predefined size.

[0040] In an example where the lighting control information at the second priority level includes a request to change the color of light, the request may comprise, for example, one of the following: an identification of a requested one of two or more predefined colors of light, respective indications of requested relative intensities of light output to be applied for light sources of two or more different colors, respective indications of requested changes in relative intensities of light output to be applied for light sources of two or more different colors, etc.

[0041] In an example where the lighting control information at the second priority level includes a request to change the color temperature of light, the request may comprise, for example, one of the following: an identification of a requested one of two or more predefined color temperatures of light, respective indications of requested relative intensities of light output to be applied for light sources of two or more different color temperatures, respective indications of requested changes in relative intensities of light output to be applied for light sources of two or more different color temperatures, etc.

[0042] In an example where the lighting control information at the second priority level includes a request to apply temporal variations in the light output, the request may comprise, for example, one of the following: an identification of a requested one of two or more predefined lighting control profiles that define respective changes in one or more light output characteristics as a function of time, a set of parameters that specify one or more aspects of a lighting control profile that defines respective changes in one or more light output characteristics as a function of time. In an example, a lighting control profile may define respective values of one or more of the following light output characteristics as a function of time: (absolute or relative) light intensity applied for providing the light output, (absolute or relative) light level resulting from the light output, color of the light output, color temperature of the light output. In case the lighting control in this regard relies on selection of one of the two or more predefined lighting control profiles, the two or more lighting control profiles may include a lighting control profile that defines a circadian rhythm and/or a lighting control profile that

defines a natural rhythm (e.g. one that defines changes in light level that follow the amount of ambient light outdoors over time).

[0043] Along the lines described in the foregoing with references to block 202, the respective one or more lighting control messages that originate from a certain user apparatus 150 may be derived based on user input acquired at the respective user apparatus 150. As an example in this regard, the user input may be received via the UI of the user apparatus 150 upon derivation of the one or more lighting control messages therein, whereas in another example the user input may be acquired earlier, stored in a memory at the user apparatus 150 for subsequent use, and accessed upon derivation of the one or more lighting control messages at the user apparatus 150. In both these approaches the user apparatus 150 or its user may be authorized to transmit lighting control information at the first and second priority levels or the user apparatus 150 or its user may be authorized to transmit lighting control information at the second priority level while not being authorized to transmit lighting control at the first priority level. The authorization to transmit lighting control information at the first and second priority levels or at the second priority level only may be defined upon installation or configuration of the lighting control application for the user apparatus 150 e.g. by an administrator of the lighting system 100 and information that defines the authorization may be stored in a memory at the respective user apparatus 150 and this information may be applied by the lighting control application upon deriving the one or more lighting control messages.

[0044] In an example where the user input serving as the basis of the one or more lighting control messages is received via the UI upon derivation of the one or more lighting control messages, the lighting control application may provide the user (via the UI) with a possibility to enter requests for adjusting lighting characteristics according to his/her needs or preferences in accordance with the authorization defined via the lighting control application and the lighting control application may transform the received user input into corresponding one or more lighting control messages for transmission to the lighting control apparatus 140. In an example where the user input serving as the basis of the one or more lighting control messages is pre-stored in a memory at the user apparatus 150, the lighting control application may automatically derive (and transmit) the one or more lighting control messages upon the user activating the lighting control application at the user apparatus 150. In such an example, the user input comprising request(s) for adjusting the lighting characteristics according to his/her needs or preferences may be entered (via the UI) and stored in the memory upon installation, configuration or reconfiguration of the lighting control application for the user apparatus 150.

[0045] Along the lines described in the foregoing with references to block 204, the one or more user apparatuses 150 may transmit the respective one or more light-

ing control messages derived therein over the one or more wireless communication channels to the lighting control apparatus 140. In this regard, the one or more lighting control messages may be conveyed from the user apparatus 150 to the lighting control apparatus 140 in one or more protocol data units (PDUs) of an underlying data transport protocol. As a non-limiting example in this regard, the transport of the one or more lighting control messages may be provided via usage of a suitable short-range wireless communication technique, e.g. one of the short-range wireless techniques discussed in the foregoing. In a particular example, the one or more lighting control messages may be conveyed using advertising messages of the BLE advertising channel PDUs, which may be also referred to as BLE advertising packets, as BLE advertisements or as BLE adverts. In this regard, the one or more lighting control messages may be transmitted (e.g. broadcast) in a respective user-definable data fields of one or more BLE advertising packets. The employed BLE advertising packets may comprise, for example, connectable undirected advertising (ADV_IND) packets, non-connectable undirected advertising (ADV_NONCONN_IND) packets, scannable undirected advertising (ADV_SCAN_IND) packets and/or connectable directed advertising (ADV_DIRECT_IND) packets, where sensor indication messages may be included e.g. in the Complete Local Name fields and/or in a Manufacturer Specific Data sections of the applied BLE advertising packets. In a variation of the above example that involves 'legacy' BLE advertising packets, according to another example the employed BLE packets may comprise extended advertising (ADV_EXT_IND) packets transmitted on a primary advertising channel together with additional advertising data packets (e.g. AUX_ADV_IND, AUX_SCAN_IND, AUX_CHAIN_IND) transmitted on a secondary advertising channel.

[0046] While the examples described in the foregoing (and in the following) implicitly assume transmission of the respective one or more lighting control messages from the one or more user apparatuses 150 without a need for any prior communication with the control apparatus 140, in other examples the user apparatus 150 may transmit the respective one or more lighting control messages to the lighting control apparatus 140 in response to receiving, over the one or more wireless channels from the control apparatus 140, an indication of the control apparatus 140 accepting the lighting information from the one or more user apparatuses 150. As an example in this regard, the lighting control application may enable provision of the user input for immediate derivation and transmission of the one or more lighting control messages as a response to receiving such indication from the lighting control apparatus 140 and/or may initiate the automated transmission of the one or more lighting control messages based on pre-stored user input as a response to receiving such indication from the lighting control apparatus 140. If assuming usage of the BLE advertising packet(s) for the lighting control apparatus 140 providing

the one or more user apparatuses 150 with the indication of the control apparatus 140 accepting the lighting information from the one or more user apparatuses 150, according to an example, this indication may be transmitted using the one of the BLE advertising packet types described above. In another example. According to another example in this regard, said indication may be transmitted from the lighting control apparatus 140 in one or more scan request (e.g. SCAN_REQ or AUX_SCAN_REQ) packets, whereas the user apparatus 150 may respond to said indication by transmitting the one or more lighting control messages in one or more scan response (e.g. SCAN_RSP or AUX_SCAN_RSP) packets.

[0047] Along the lines described in the foregoing with references to blocks 206 and 208, the lighting control apparatus 140 may receive the respective one or more lighting control messages from one or more user apparatuses 150 and determine the one or more lighting control actions accordingly. In case the lighting control messages are received only from a single user apparatus 150, the lighting control apparatus 140 may directly proceed into determination and application of the one or more lighting control actions based on the lighting control information received from the single user apparatus 150 without explicit consideration of the priority level assigned to the received lighting control information.

[0048] In case the lighting control apparatus 140 receives respective lighting control messages from two or more user apparatuses 150, the resulting one or more lighting control actions may be derived in consideration of the respective priority levels assigned to the respective lighting control information originating from different ones of the two or more user apparatuses 150. As described in the foregoing, any lighting control information at a higher priority level takes precedence over any lighting control information at a lower priority level and hence, assuming the first and second priority levels described in the foregoing, any lighting control information assigned the first priority level takes precedence over any lighting control information assigned the second priority level.

[0049] Hence, in case lighting control information at the first priority level is received from only a single user apparatus 150, the lighting control apparatus 140 may directly proceed into determination and application of the one or more lighting control actions based on the lighting control information received from the respective user apparatus 150 without explicit consideration of any lighting control information at the second priority level being received from any number of other user apparatuses 150. In case respective lighting control information at the first priority level is received from two or more user apparatuses 150, the lighting control apparatus 140 may determine the resulting one or more lighting control actions in accordance with one or more predefined tie-breaking rules for the first priority level.

[0050] Assuming that the lighting control information at the first priority level includes a request for increasing the light level in the space or area illuminated by the one

or more luminaires 120, according to an example, the one or more tie-breaking rules for the first priority level may define that the one or more lighting control actions are defined based on that piece of lighting control information that requests the highest light level for the illuminated space or area. This accounts for a scenario where the lighting control information at the first priority level is applied for lighting control that reflects actual needs arising from one or more characteristics of tasks (which may e.g. require uncompromised visibility) carried out in the space or area illuminated by the one or more luminaires 120 and/or actual needs arising from one or more characteristics (e.g. a visual capability) of a person behind the respective request.

[0051] In a scenario where the lighting control apparatus 140 does not receive lighting control information at the first priority level but receives respective lighting control information at the second priority level from two or more user apparatuses 150, the lighting control apparatus 140 may determine the resulting one or more lighting control actions in accordance with one or more predefined tie-breaking rules for the second priority level. Assuming that the lighting control information at the second priority level includes a request to change a lighting characteristics in the space or area illuminated by the one or more luminaires 120, applicable tie-breaking rules for the second priority level may depend on the lighting characteristics under consideration.

[0052] In case the lighting characteristic under consideration comprises the light level in the space or area illuminated by the one or more luminaires 120, as an example, the applicable tie-breaking rule for the second priority level may define that the one or more lighting control actions are defined such that an average of the requested lighting levels will be applied, thereby resorting to a compromise between the two or more requested changes in the light level.

[0053] In case the lighting characteristic under consideration comprises the color of the light output, as an example, the applicable tie-breaking rule for the second priority level may define that the one or more lighting control actions are defined such that a predefined reference color is applied. In this regard, the predefined reference color is preferably one that may be considered as neutral (e.g. white) in order to avoid lighting characteristics that may be considered annoying by some occupants of the illuminated space or area. In case the lighting characteristic under consideration comprises the color temperature of the light output, as an example, the applicable tie-breaking rule for the second priority level may define that the one or more lighting control actions are defined such that a predefined reference color temperature is applied. In this regard, the predefined reference color temperature is preferably one that may be considered as neutral (e.g. "neutral white" at approximately 4000 K) in order to avoid lighting characteristics that may be considered annoying by some occupants of the illuminated space or area.

[0054] In case the lighting characteristic under consideration comprises temporal variations to be applied in the light output in accordance with a lighting control profile that defines one or more characteristics of the light output as a function of time and the underlying lighting control information conveys an identification of a requested one of the two or more predefined lighting control profiles, the applicable tie-breaking rule for the second priority level may define a predefined preference order for the two or more predefined lighting control profiles and further define selection of the predefined lighting control profile that has is highest in the preference order among the two or more requested lighting control profiles.

[0055] Along the lines described in the foregoing with reference to block 210, the lighting control apparatus 140 may control the respective light outputs of the one or more luminaires 120 according to the determined one or more lighting control actions. In this regard, the manner of applying the determined one or more lighting control actions via operation of the lighting control apparatus 140 may depend on the implementation of the lighting control apparatus 140: along the lines described in the foregoing, the lighting control apparatus 140 140-j according to the example of Figure 2A, the luminaire control portion 124-k therein may directly issue corresponding lighting control commands to control the light output of the luminaire 120-k accordingly, whereas the lighting control apparatus 140b according to the example of Figure 2B or the lighting control apparatus 110 according to the example of Figure 2C may determine and transmit corresponding lighting control commands over the lighting control network to the one or more luminaires 120 for adjusting their respective light outputs accordingly.

[0056] According to an example, the lighting control apparatus 140 may consider the lighting control messages received from a certain user apparatus 150 in accordance with the respective signal strengths of the (radio) signals applied to carry the respective one or more lighting control messages. In this regard, without losing generality, a measure that is descriptive of a strength of the signal carrying the one or more lighting control messages (or part thereof) may be referred to as a received signal strength indicator (RSSI). As an example, the lighting control apparatus 140 may consider only those lighting control messages that have been received at a RSSI that exceeds a RSSI threshold. Suitable selection of the RSSI threshold may ensure that only those lighting control messages that are transmitted from user apparatuses 150 that are relatively close to the lighting control apparatus 140 and that may hence be considered to reside within (or at least close to) the space or area illuminated by the one or more luminaires 120 are taken into consideration in derivation of the one or more lighting control actions.

[0057] According to an example, respective instances of the lighting control application executing in the one or more user apparatuses 150 may transmit the respective lighting control messages derived based on the respec-

tive user input obtained therein repeatedly to indicate a continuous request to adjust the light output accordingly. In this regard, the repeated transmission of the one or more lighting control messages may be carried out according to a predefined schedule, e.g. at predefined time intervals. In this regard, the time interval may be chosen, for example, in a range from ten seconds to a few minutes. Consequently, repeated reception of the respective one or more lighting control messages at the lighting control apparatus 140 from a certain user apparatus 150 may serve as an indication of continued presence of the respective user apparatus 150 within the illuminated space or area (or in its close proximity). In some examples, the lighting control apparatus 140 may consider only those lighting control messages that originating from those user apparatuses 150 that have transmitted the respective one or more lighting control messages according to the predefined schedule for at least a time period of predefined duration. In other words, the lighting control information received from a certain user apparatus 150 becomes valid after the lighting control apparatus 140 having received lighting control messages from the respective user apparatus 150 according to the predefined schedule for a time period of predefined duration. In this regard, the predefined duration may be, for example, in a range from ten seconds to a few minutes. Such an approach may ensure that only those user apparatuses 150 that reside within the space or area illuminated by the one or more luminaires 120 (or in its close proximity) enable control of illumination in the space or area.

[0058] The examples described in the foregoing refer to lighting control information transmitted at one of the two or more predefined priority levels, whereas in some examples the first priority level and the second priority level are applied as examples of the two or more priority levels. In further examples, the two or more priority levels may include the first priority level according to the examples described in the foregoing together with a second and third priority levels (and possibly together with one or more further priority levels), where the first priority level is higher than the second and third priority level and the second priority level is higher than the third priority level. In particular, the second and third priority levels of this example may be applied as follows:

- lighting control information at the second priority level may comprise a request to adjust or change a lighting control profile that defines respective changes in one or more light output characteristics as a function of time,
- lighting control information at the third priority level may comprise a request to adjust one of the following characteristics of the light output: the light level, the color of the light output, the color temperature of the light output.

[0059] Hence, in other words, application of the first, second and third priority levels as described this example

prioritizes requests for changing or adjusting the lighting control profile over direct requests for changing or adjusting a certain characteristics of the light output. Along the lines described in the foregoing, the user apparatus 140 or its user may be authorized to transmit lighting control information at the first, second and third priority levels, to transmit lighting control information at the second and third priority levels only, or to transmit lighting control information at the third priority level only, whereas the authorization may be handled in the manner described in the foregoing for the example that involved the first and second priority levels, *mutatis mutandis*.

[0060] Further regarding the authorization of a certain user apparatus 140 or its user to transmit lighting control information at different priority levels, the examples provided in the foregoing describe authorization that is defined and applied at the one or more user apparatuses 150, which allows for the lighting control apparatus 140 to assume that the lighting control information received in the respective one or more lighting control messages originating from the one or more user apparatuses 150 originates from authorized sources. According to another example, the authorization of a certain user apparatus 150 to apply lighting control information at various priority levels may be defined via the lighting control apparatus 140 instead. In this regard, the one or more lighting control messages and/or the PDUs carrying them originating from a certain user apparatus 150 may include a device identifier (ID) assigned to the respective user apparatus 150, while the lighting control apparatus 140 may have access to authorization information that defines respective authorization for a plurality of device IDs in terms of the priority levels the respective user apparatus 150 is authorized to apply. Hence, the lighting control apparatus may consult the authorization information upon receiving the one or more lighting control messages from a certain user apparatus 150 and consider the lighting control information received in these one or more lighting control message only in case the respective lighting control information is assigned a priority level the respective user apparatus is authorized to apply. In another example of the lighting-control-apparatus-based authorization, the one or more lighting control messages and/or the PDUs carrying them originating from a certain user apparatus 150 may include a user ID assigned to a (current) user of the respective user apparatus 150, whereas the authorization may be verified at the lighting control apparatus in a manner similar to that described above for the device ID, *mutatis mutandis*.

[0061] The lighting control approach that involves transmission of the lighting control information at one of two or more predefined priority levels from the one or more user apparatuses 150 to the lighting control apparatus 140 via the examples provided in the foregoing (and in the following) may be applied, for example, to convey lighting control requests of two different types respective user apparatuses 150 operated by respective occupants of the space or area illuminated by the one or more lu-

minaires 120:

- lighting need message, which may convey a request for increased light level due to specific requirements of tasks carried out in the illuminated space or are or due to visual capacity of a person carrying out these tasks,
- lighting preference message, which may convey a requires for adjusting the lighting characteristics in a manner that is preferred by the respective occupant of the space.

[0062] In particular, lighting control messages that convey lighting control information at the first priority level may be applied as the lighting need messages, whereas lighting control messages that convey lighting control information at the second (or third) priority level may be applied as the lighting preference messages, thereby providing a scenario where the lighting need messages always take preference over the lighting preference messages.

[0063] In a particular example, the user apparatus 150 may derive respective one or more lighting control messages that carry lighting control information at the first priority level that include an indication of a requested amount of increase in light level with respect to the predefined reference light level to convey a lighting need message, where such lighting control messages may be derived in response to user input acquired therein indicating one of the following:

- compromised visual capability of an occupant of the illuminated space or area,
- activities carried out in the illuminated space or area such that uncompromised visibility is critical, errors made in the course of the activity are impossible or costly to rectify, the activity requires exceptional accuracy or concentration and/or the activity involves details of unusually small size or low contrast.

[0064] In a variation of the above-described approach, lighting control messages serving as a lighting need message may include one or more reason codes for increasing the light level, whereas the lighting control apparatus 140 may apply a predefined mapping data to find an amount of increase in the light level with respect to the predefined reference light level that corresponds to the one or more reason codes received in the lighting control messages. In this regard the one or more reason codes chosen from a plurality of predefined reason that may include a first reason code that serves to indicate a request for increased light level due to characteristic of the activity carried out in the illuminated area and a second reason code that serves to indicate a request for increased light level due to a characteristic of an occupant of the illuminated space or area.

[0065] Along similar lines, the user apparatus 150 may derive respective one or more lighting control messages

that carry lighting control information at the second or third priority level that include a respective indication of one of the following to convey a lighting preference message:

- an identification of a requested one of two or more predefined light levels (e.g. one of "low", "mid", "high", where "mid" may correspond to the reference light level described above),
- an identification of a requested one of two or more predefined color temperatures of light (e.g. one of "cool", "neutral", "warm", where "neutral" may correspond to the reference light color temperature described above),
- an identification of a requested one of two or more predefined lighting control profiles that define respective changes in one or more light output characteristics as a function of time (e.g. one of a circadian rhythm or a natural rhythm).

[0066] Figure 5 illustrates a block diagram of some components of an apparatus 400 that may be employed to implement at least some of the operations described with references to the respective one of the lighting control apparatus 140 or the user apparatus 150. The apparatus 400 comprises a processor 410 and a memory 420. The memory 420 may store data and computer program code 425. The apparatus 400 may further comprise communication means 430 for wired or wireless communication with other apparatuses, where the communication means 430 may comprise the respective one of the communication portions 123-k, 143-j, 143-k. The apparatus 400 may further comprise user I/O (input/output) components 440 that may be arranged, together with the processor 410 and a portion of the computer program code 425, to provide a user interface for receiving input from a user and/or providing output to the user. In particular, the user I/O components may include user input means, such as one or more keys or buttons, a keyboard, a touchscreen or a touchpad, etc. The user I/O components may include output means, such as a display or a touchscreen. The components of the apparatus 400 are communicatively coupled to each other via a bus 450 that enables transfer of data and control information between the components.

[0067] The memory 420 and a portion of the computer program code 425 stored therein may be further arranged, with the processor 410, to cause the apparatus 400 to perform at least some aspects of controlling operation of the respective one of the lighting control apparatus 140 or the user apparatus 150. The processor 410 is configured to read from and write to the memory 420. Although the processor 410 is depicted as a respective single component, it may be implemented as respective one or more separate processing components. Similarly, although the memory 420 is depicted as a respective single component, it may be implemented as respective one or more separate components, some or all of which

may be integrated/removable and/or may provide permanent / semi-permanent/ dynamic/cached storage.

[0068] The computer program code 425 may comprise computer-executable instructions that implement at least some aspects of controlling operation of the respective one of the lighting control apparatus 140 or the user apparatus 150 when loaded into the processor 410. As an example, the computer program code 425 may include a computer program consisting of one or more sequences of one or more instructions. The processor 410 is able to load and execute the computer program by reading the one or more sequences of one or more instructions included therein from the memory 420. The one or more sequences of one or more instructions may be configured to, when executed by the processor 410, cause the apparatus 400 to perform at least some aspects of controlling operation of the lighting control apparatus 140 or the user apparatus 150. Hence, the apparatus 400 may comprise at least one processor 410 and at least one memory 420 including the computer program code 425 for one or more programs, the at least one memory 420 and the computer program code 425 configured to, with the at least one processor 410, cause the apparatus 400 to perform at least some aspects of controlling operation of the lighting control apparatus 140 or the user apparatus 150.

[0069] The computer program code 425 may be provided e.g. a computer program product comprising at least one computer-readable non-transitory medium having the computer program code 425 stored thereon, which computer program code 425, when executed by the processor 410 causes the apparatus 400 to perform at least some aspects of controlling operation of the lighting control apparatus 140 or the user apparatus 150. The computer-readable non-transitory medium may comprise a memory device or a record medium that tangibly embodies the computer program. As another example, the computer program may be provided as a signal configured to reliably transfer the computer program.

[0070] Reference(s) to a processor herein should not be understood to encompass only programmable processors, but also dedicated circuits such as field-programmable gate arrays (FPGA), application specific circuits (ASIC), signal processors, etc.

Claims

1. A method (200) for lighting control, the method (200) comprising:

receiving (206), over one or more wireless communication channels at a lighting control apparatus (140), respective one or more lighting control messages from one or more user apparatuses (150), wherein the one or more lighting control messages received from a respective one of the one or more user apparatuses (150)

include respective lighting control information at one of two or more predefined priority levels; determining (208), by the lighting control apparatus (140), one or more lighting control actions for controlling respective light outputs of one or more luminaires (120) based on the respective lighting control information received from said one or more user apparatuses (150) in accordance with the respective priority levels; and controlling (210), by the lighting control apparatus (140), the respective light outputs of one or more luminaires (120) in accordance with the determined one or more lighting control actions.

2. A method (200) according to claim 1, further comprising deriving (202), at said one or more user apparatuses (150), the respective one or more lighting control messages based on respective user input obtained at a respective user apparatus (150); and transmitting (204) the respective one or more lighting control messages from said one or more user apparatuses (150) over said one or more wireless communication channels to the lighting control apparatus (140).

3. A method (200) according to claim 1 or 2, wherein any lighting control information assigned a higher priority level takes precedence over any lighting control information at a lower priority level.

4. A method (200) according to any of claims 1 to 3, wherein lighting control information at a first priority level comprises a request for increased light level, and wherein the one or more lighting control actions comprise increasing the respective light outputs of said one or more luminaires (120) according to respective requests received from at least one of said one or more user apparatuses (150).

5. A method (200) according to claim 4, wherein lighting control information at the first priority level comprises an indication of a requested amount of increase in light level, and wherein determining (208) the one or more lighting control actions comprises determining the one or more lighting control actions according to the respective requested amounts of increase in light level received from at least one of said one or more user apparatuses (150).

6. A method (200) according to claim 4, wherein lighting control information at the first priority level comprises respective identifications of one or more reason codes for increasing

- the light level, and
 wherein determining (208) the one or more lighting control actions comprises determining the one or more lighting control actions according to on the respective one or more reason codes received from at least one of said one or more user apparatuses (150). 5
7. A method (200) according to any of claims 1 to 6, 10
 wherein lighting control information at a second priority level that is lower than the first priority level comprises a request to change a characteristic of the respective light outputs of said one or more luminaires (120), and
 wherein the one or more lighting control actions comprise adjusting said characteristics of the respective light outputs of said one or more luminaires (120) according to respective requests received from at least one of said one or more user apparatuses (150). 15
8. A method (200) according to claim 7, wherein said characteristics comprises one of the following: light level, color of the light output, color temperature of the light output, temporal variations applied to the light output. 20 25
9. A method (200) according to claim 7, 30
 wherein lighting control information at the second priority level comprises an identification of a requested one of two or more predefined light levels, and
 wherein determining (208) the one or more lighting control actions comprises determining an applicable light level based on the respective identifications received from at least one of said one or more user apparatuses and determining the one or more lighting control actions according to the determined light level. 35 40
10. A method (200) according to claim 7, 45
 wherein lighting control information at the second priority level comprises an identification of a requested one of two or more predefined light color temperatures, and
 wherein determining (208) the one or more lighting control actions comprises determining an applicable light level based on the respective indications received from at least one of said one or more user apparatuses and determining the one or more lighting control actions according to the determined light level. 50 55
11. A method (200) according to claim 7,
- wherein lighting control information at the second priority level comprises an identification of a requested one of two or more predefined lighting control profiles that define respective changes in one or more light output characteristics as a function of time, and
 wherein determining (208) the one or more lighting control actions comprises selecting one of the requested lighting control profiles for application at the lighting control apparatus (140) and determining the one or more lighting control actions as a function of time according to the selected lighting control profile.
12. A method (200) according to any of claims 1 to 11, wherein said wireless channel comprises a channel of a short-range wireless communication network.
13. A method (200) according to any of claims 1 to 12, wherein said wireless channel comprises a Bluetooth Low Energy advertising channel and wherein the one or more lighting control messages are conveyed in one or more Bluetooth Low Energy advertising protocol data units.
14. A lighting control apparatus (110, 140, 140b, 140-k) arranged to:
 receive, over one or more wireless communication channels, respective one or more lighting control messages from one or more user apparatuses (150), wherein the one or more lighting control messages received from a respective one of the one or more user apparatuses (150) include respective lighting control information at one of two or more predefined priority levels; determine one or more lighting control actions for controlling respective light outputs of one or more luminaires (120) based on the respective lighting control information received from said one or more user apparatuses (150) in accordance with the respective priority levels; and control respective light outputs of one or more luminaires (120) in accordance with the determined one or more lighting control actions.
15. A user apparatus arranged to:
 derive, based on user input obtained at the user apparatus, one or more lighting control messages for transmission to a lighting control apparatus, wherein the one or more lighting control messages include respective lighting control information at one of two or more predefined priority levels; and transmit said one or more lighting control messages over said wireless channel for reception at the lighting control apparatus.

16. A system comprising:

a lighting control apparatus according to claim 14; and
one or more user apparatuses according to claim 15.

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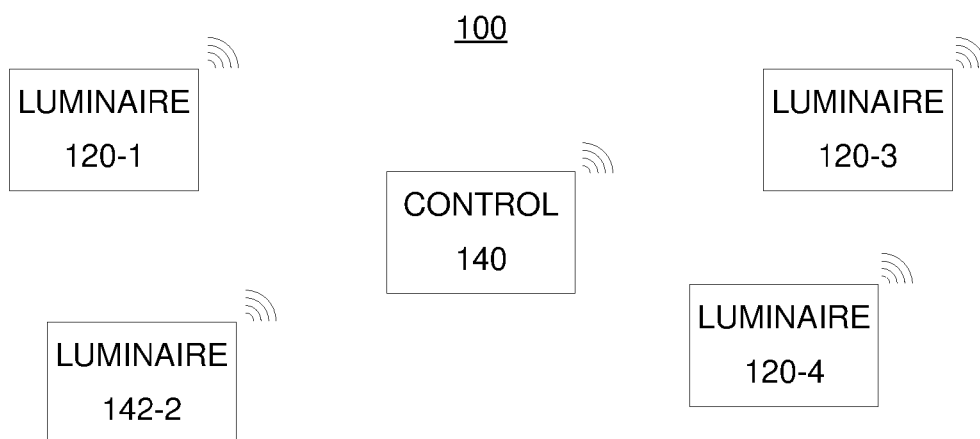


Figure 1

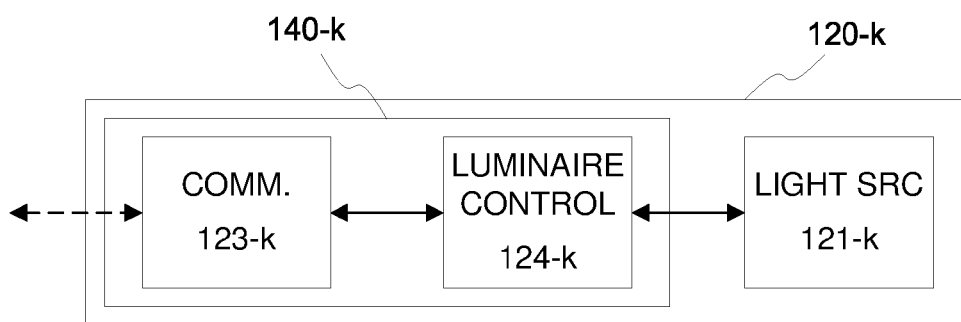


Figure 2A

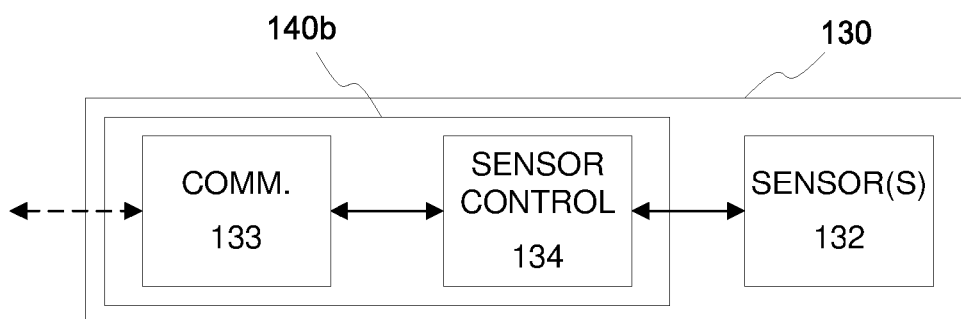


Figure 2B

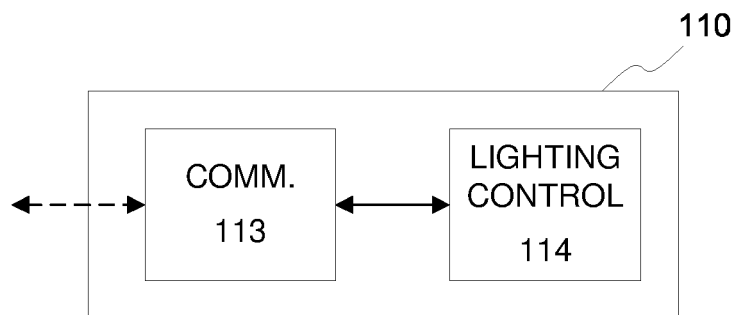


Figure 2C

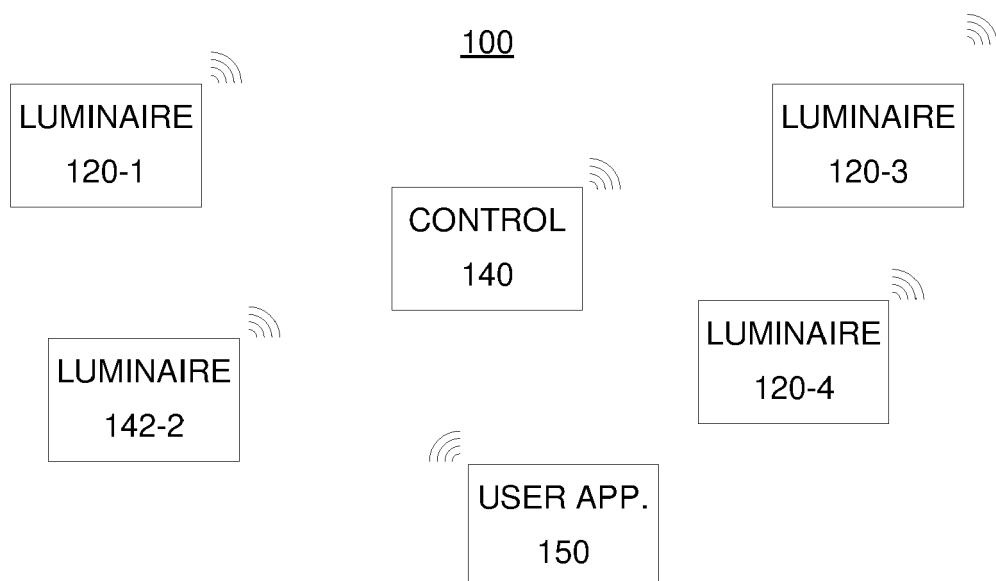


Figure 3

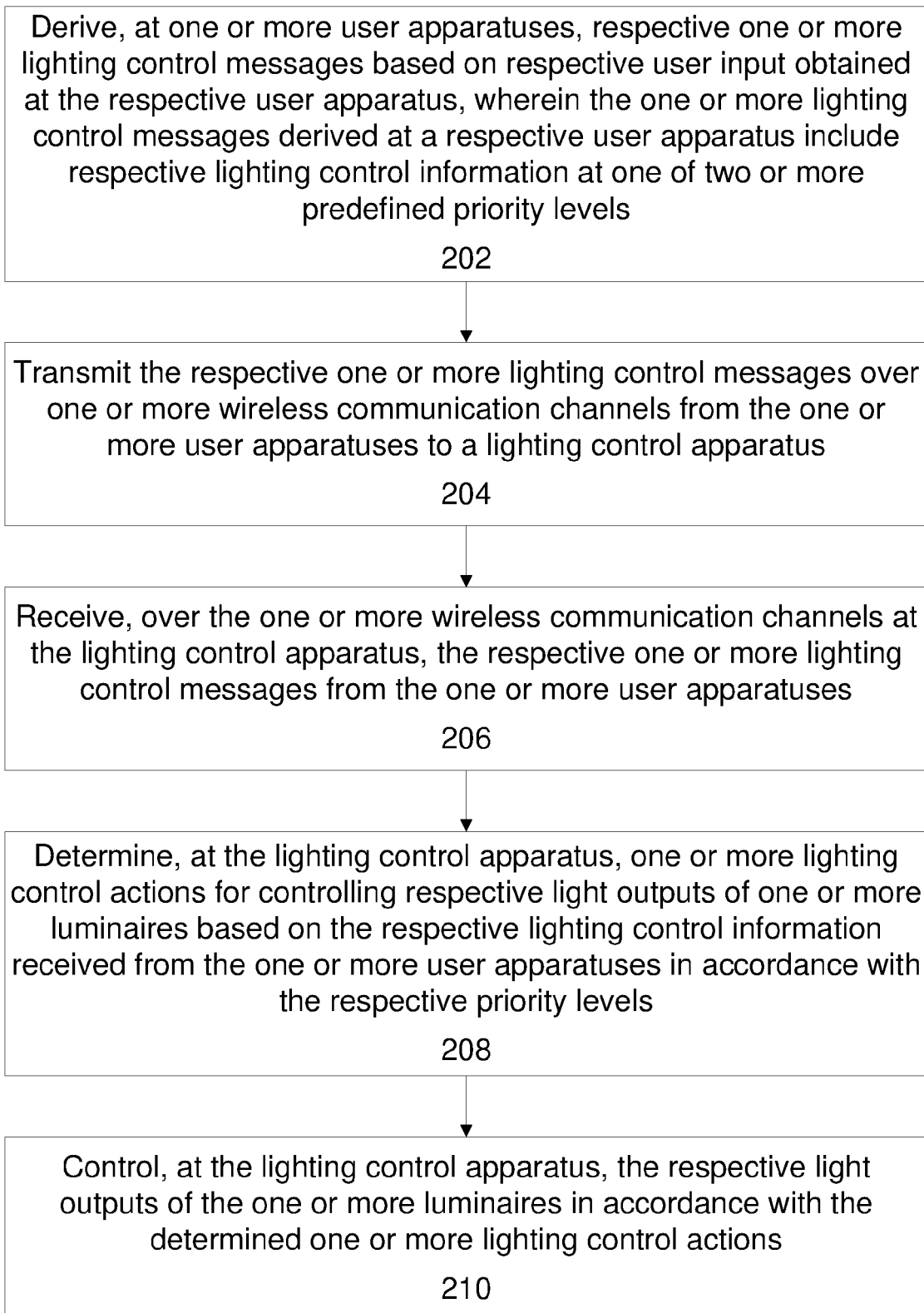
200

Figure 4

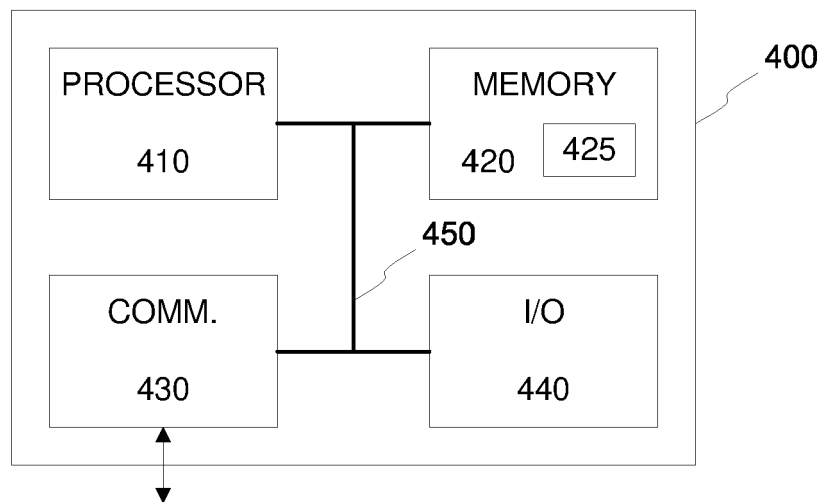


Figure 5



EUROPEAN SEARCH REPORT

Application Number

EP 22 20 2060

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2014/024078 A1 (KONINKL PHILIPS NV [NL]) 13 February 2014 (2014-02-13)	1-3, 14-16	INV. H05B47/19
Y	* page 1, paragraph 1; figures 1-3, 4A-4B	12,13	
A	* * page 1, paragraph 3 - page 27, paragraph 4 * * page 28, paragraph 2 - page 32, paragraph 3 *	4-11	
X	US 2016/092198 A1 (VANGEEL JURGEN MARIO [BE] ET AL) 31 March 2016 (2016-03-31)	1-5, 7-11, 14-16	
Y	* page 1, paragraph 2; figures 1-30 *	12,13	
A	* page 2, paragraph 17 - page 3, paragraph 23 * * page 6, paragraph 79 - page 37, paragraph 303 * * esp. pars. [0098], [0101], [0145], [0210]-[0213], [0281] *	6	
Y	EP 3 820 255 A1 (HELVAR OY AB [FI]) 12 May 2021 (2021-05-12)	12,13	TECHNICAL FIELDS SEARCHED (IPC)
	* column 1, paragraph 1; figures 1-3, 4A-4D * * column 2, paragraph 7 - column 4, paragraph 14 * * column 4, paragraph 18 - column 22, paragraph 91 * * esp. par. [0022] *		H05B F24F G05B A61N
The present search report has been drawn up for all claims			

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Place of search	Date of completion of the search	Examiner
Munich	29 March 2023	Broza, Anna-Maria
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document		

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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29-03-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014024078 A1	13-02-2014	BR 112015002572 A2	04-07-2017
		CN 104509216 A	08-04-2015
		EP 2883423 A1	17-06-2015
		JP 6461791 B2	30-01-2019
		JP 2015534295 A	26-11-2015
		RU 2015107760 A	27-09-2016
		US 2015208489 A1	23-07-2015
		WO 2014024078 A1	13-02-2014
US 2016092198 A1	31-03-2016	CN 106716270 A	24-05-2017
		CN 106716271 A	24-05-2017
		CN 106717117 A	24-05-2017
		CN 106717118 A	24-05-2017
		CN 106922183 A	04-07-2017
		CN 110099482 A	06-08-2019
		EP 3201695 A1	09-08-2017
		EP 3201697 A1	09-08-2017
		EP 3201698 A2	09-08-2017
		EP 3201699 A1	09-08-2017
		EP 3202238 A1	09-08-2017
		ES 2869394 T3	25-10-2021
		ES 2907454 T3	25-04-2022
		HU E057863 T2	28-06-2022
		JP 6667512 B2	18-03-2020
		JP 6742993 B2	19-08-2020
		JP 6742994 B2	19-08-2020
		JP 7002330 B2	20-01-2022
		JP 2017528895 A	28-09-2017
		JP 2017528896 A	28-09-2017
		JP 2017528897 A	28-09-2017
		JP 2017528898 A	28-09-2017
		JP 2017529674 A	05-10-2017
		PL 3201699 T3	02-05-2022
		RU 2017114627 A	05-11-2018
		RU 2017114660 A	02-11-2018
		US 2016091217 A1	31-03-2016
		US 2016092198 A1	31-03-2016
		US 2016095189 A1	31-03-2016
		US 2016095191 A1	31-03-2016
		US 2016095192 A1	31-03-2016
		US 2017223811 A1	03-08-2017
		US 2017311418 A1	26-10-2017
		US 2017318647 A1	02-11-2017
		US 2018077778 A1	15-03-2018
		WO 2016050537 A1	07-04-2016
		WO 2016050571 A1	07-04-2016

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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 22 20 2060

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-03-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		WO 2016050676 A2	07-04-2016
		WO 2016050704 A1	07-04-2016
		WO 2016050707 A1	07-04-2016

EP 3820255	A1	12-05-2021	NONE

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82